ROLLING ENERGY RESOURCES

Electric Vehicle Telematics Data

Presentation for the New York EV Technical Standards Working Group

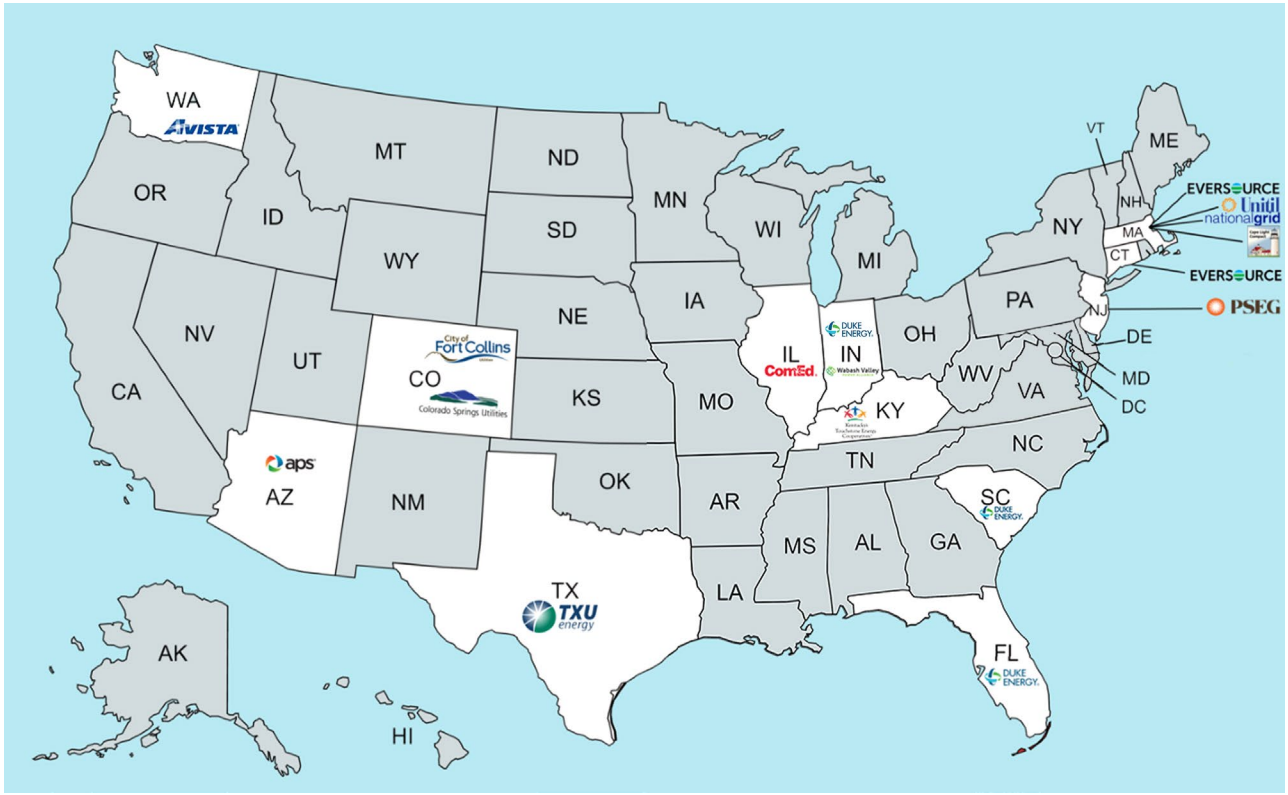
April 26, 2023

Questions to Address

- How RER collects kWh from vehicle telematics
- Evidence on accuracy
- Recommendations on what the metering accuracy testing initiative should consider

Background on RER

- Launched in 2019 by DSM professionals
- Completed Seed and Series rounds with recent growth
- Running both behavior and active load control programs throughout the U.S.



How does RER collect kWh?

Collecting Telematics Data

- RER connects directly to the vehicle APIs
- Customer opt-in (utility incentives help)
- Cover over 95% of EVs on the road today

Telematics Data Points

Electric vehicles capture or can access many data points related to the state of the vehicle

Location

Odometer

Current battery percent and estimated remaining range

Charging status, plugged in status

<u>However</u>, kW and kWh are generally not captured and must be estimated.

Vehicle Telematics Challenge

- Connecting to the car turns out to be less of a challenge
  - Various third-party providers who focus on telematics access
  - Data used by insurance companies, car rental services, state department of transportation offices, etc.
- The real challenge: cleaning, interpreting, and turning the data into actionable programs
  - Each OEM is its own data project
  - Some OEMs have rate limiting on the number of times a vehicle can be polled in a day before it will refuse to return data
  - Certain important data must be estimated from what the OEM collects
  - Additional data are combined with Telematics to produce better information with cross validation
  - The quality of the translation algorithms is important

Telematics Data Quality Validation, and Adjustment

Selected Data Issues:

Stale data

- Most common problem is that a vehicle returns stale data
  - Often because of sleeping but can also be random
- Can usually be removed deduplicated by looking at other data points and comparing data timestamp to query timestamp

Recalibration

- Occasionally vehicles recalibrate internal calculations of battery percent, leading to small jumps or dips
- Need to infer from context whether this was driving, charging, or just an internal adjustment

Telematics Data Quality (Cont.)

Selected Data Issues:

Missing data

- Sometimes a vehicle fails to return data for a given field
- Usually this is obvious because it's a blank data point
- Corrected via interpolation/estimation using best practices for missing data – use other data to adjust interpolation

Errors

- Occasionally vehicles return strange data, such as:
  - Returning (0,0) for location
  - Returning the location of their manufacturing plant for location
  - Odometer decreases
  - Return 0 for battery percent while driving, then jumping back up

All need to be corrected based on context

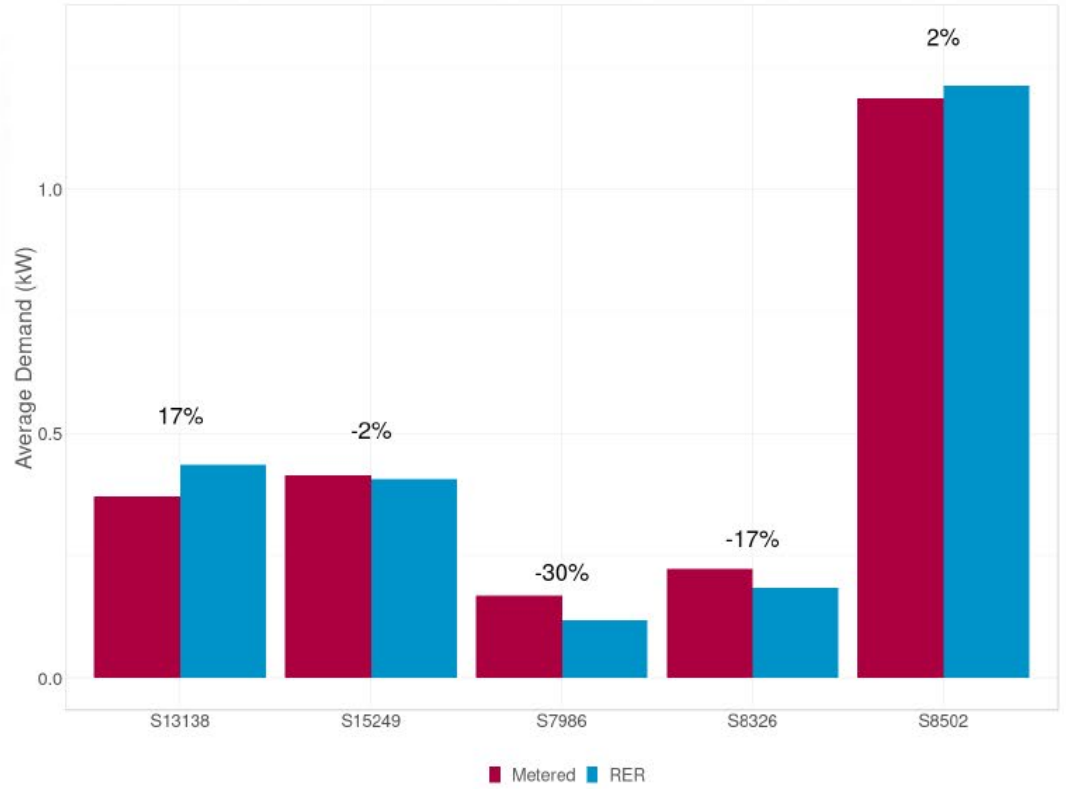
Evidence on Accuracy

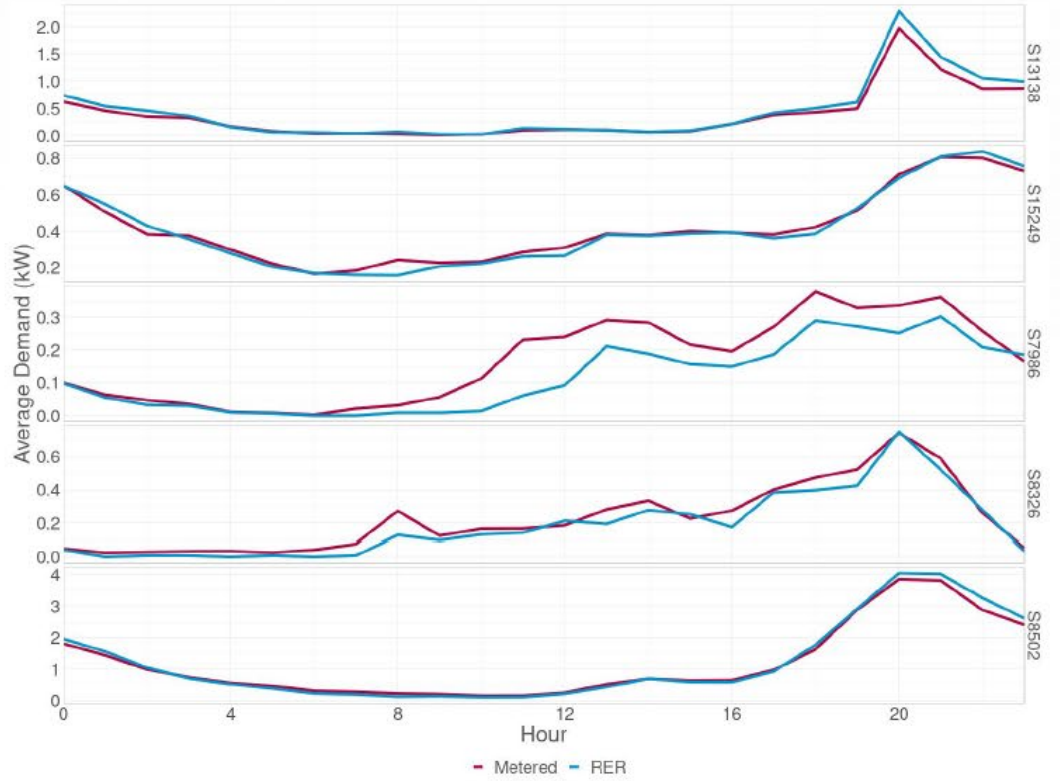
Evidence on Accuracy

- Guidehouse conducted a verification study in 2021-2022 to assess accuracy of RER vehicle telematics data
- Out of the target of 10 sites with combined RER and metering data collection, GH achieved 7 sites. Limitations in recruitment included:
  - Guidehouse decided to omit Chevrolet EVs from the study, due to safety concerns related to a battery recall
  - The response rate to the metering sample recruitment was low
- After QC, there were 5 sites with sufficient data to perform the validation
  - Data collection issues regarding the end-use meters led to an invalid comparison 2 sites

Guidehouse Study Results

- Conclusion: The RER data showed reasonable accuracy for this verification





Lessons Learned by End-Use Metering

- Evaluator ultimately decided to use vehicle telematics dataset over smaller metered dataset for analyzing electric vehicle load impacts and load shapes, deemed to have high accuracy after comparison to metered data.
- Telematics approach allowed evaluators to differentiate between EV charging location (variations in space) vs EV charging timing as measured at the charger (variations in time).
- RER learned a lot from comparisons with verified data using high quality metering at the panel in Massachusetts, made algorithm improvements
- Telematics-based approaches get better over time as we get more testing data to better calibrate models to metered kW and kWh.

Recommendations for What the Metering Accuracy Testing Initiative Should Consider

Recommendations

Sample Size

Stratification

Meter Selection

Recommendations: Sample Size

- In our industry, considerable research has been conducted on "best practices" for verifying end-use energy consumption (e.g., Uniform Methods Project)
- It will be useful (if not important) to lean on this best practice research to produce highest quality results while managing the costs of the research *(which could be high if thought is not given to the approaches used).*
- Concepts to be applied use verification statistical methods which use realization rates and ratio estimates.
  - These methods take the estimates of energy use and then verify these initial estimates against higher-quality producing a ratio of the initial estimates to the verified estimates.
  - It has been demonstrated that these approaches can reduce needed sample sizes while at the same time producing more precise verified values.

Recommendations: Stratification

- OEM: Different OEMs collect data in different ways, results across OEMs may vary
- L1 vs. L2: Different charging behaviors, line loss, etc.
- Telematics providers: Since different Telematics companies use different approaches and algorithms, the results for one telematics company may be different from other companies.

Recommendations: Meter Selection

- Need to carefully consider what meters to use:
  - It's not just the accuracy of meter that matters
  - Placement is important (at the wall or at the panel)
  - Is the meter use impacted by temperature, current, voltage, power factor
  - How dependent is the metering solution on communications? Meters that include significant onboard data storage are more resilient to communication system problems.
- Need to consider where the meter is installed
  - Goal is usually kWh consumed at home meter
  - Long cords (20-30 feet) can have significant line loss
  - Efficiency of charger is important too

THANK YOU!

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Electric Vehicle Management for Utilities

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